

Observations on the Copulatory Behavior of *Littorina rudis* (Maton) and *Littorina nigrolineata* Gray

(Gastropoda : Prosobranchia)

BY

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(4 Text figures)

INTRODUCTION

HIGH INTERTIDAL MARINE snails are active mainly under conditions of high relative humidity, such as occur when the tide recedes and on cool nights (BERRY, 1961; own observations). When the time available for movement is limited, as occurs in the supralittoral zone, copulation by males with individuals other than females of their own species will be disadvantageous. Nevertheless, casual observations on the copulatory behaviour of the *Littorina saxatilis* species complex (for a discussion of this group see HELLER, 1975; RAFFAELLI, in prep.) suggested that interspecific copulations were not uncommon. An investigation of the copulatory behaviour of 2 species within the species-complex *L. rudis* (Maton, 1797) and *L. nigrolineata* Gray, 1839 was carried out in Anglesey, North Wales in order to evaluate the extent of copulation by males with individuals other than conspecific females.

METHODS

Observations were made at Trwyn y Penrhyn, Anglesey (Figure 1), a south-east facing, semi-sheltered (3 on Lewis' exposure scale; LEWIS, 1964), fucoïd dominated boulder shore. On 25th May, 1973, 5th and 15th May, 1975 copulating pairs of *Littorina rudis* and *L. nigrolineata* were collected as the tide receded when animal activity was greatest. Sample sizes are shown in Table 1. Pairs were considered to be copulating only if the penis of one individual was inserted inside the mantle cavity of the other. This was easily seen if the copulating pair was turned apertures uppermost and gently separated. Shell heights (Figure 2)

were measured to the nearest 0.1 mm and snails were dissected to determine their sex.

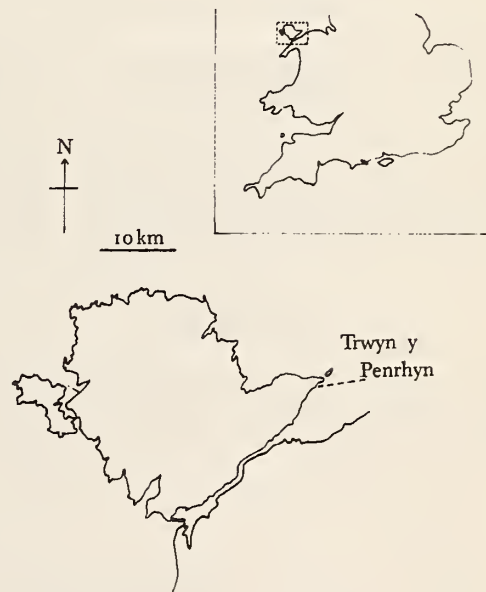


Figure 1
Location of Study Site

RESULTS

Approximately half the copulations in which *Littorina rudis* males were the 'active partners', *i. e.*, their penes were inserted inside the mantle cavity of the partner, involved *L. rudis* females and there was a similar trend

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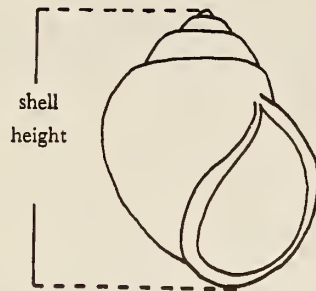


Figure 2
Definition of Shell Height

for copulations in which *L. nigrolineata* males were the active partners (Table 1).

Copulations by male *Littorina rudis* and *L. nigrolineata* which did not involve conspecific females were with males of their own species or with females and males of other species.

There was no relationship between the size of male and female *Littorina rudis* and *L. nigrolineata* involved in intraspecific copulations (Figures 3 and 4).

DISCUSSION

BERRY (1956) reported copulations between males of *Littorina rudis* and *L. littorea* juveniles. Although BERRY

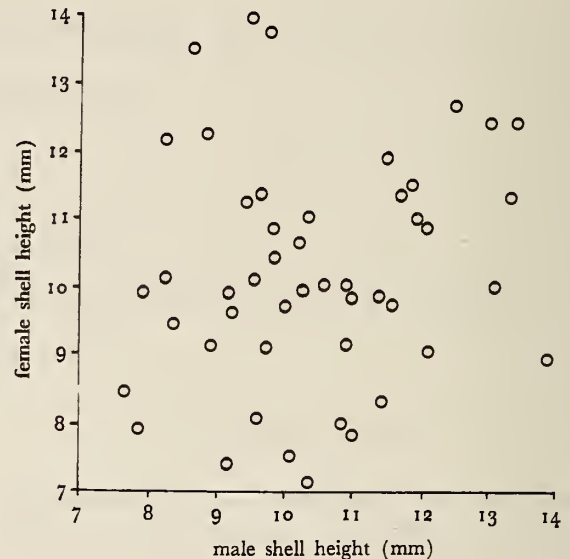


Figure 3
Relationship between size of male and size of female *Littorina rudis* involved in intra-specific copulations

(1956, 1961) described his specimens as *L. saxatilis*, subsequent investigation of his population at Whitstable, Kent has shown it to be entirely *L. rudis* (RAFFAELLI, unpublished, 1975). Copulations by males with males and females of other species and with conspecific males have

Table 1

Frequencies of male × female intraspecific copulations of *Littorina rudis* and *Littorina nigrolineata* at Trwyn y Penrhyn.

Date	Number of copulations by <i>Littorina rudis</i> males	Number of intraspecific male × female copulations
25.5.73	15	8
5.5.75	27	14
14.5.75	67	35
Date	Number of copulations by <i>Littorina nigrolineata</i> males	Number of intraspecific male × female copulations
25.5.75	9	3
5.5.75	15	7
14.5.75	12	8

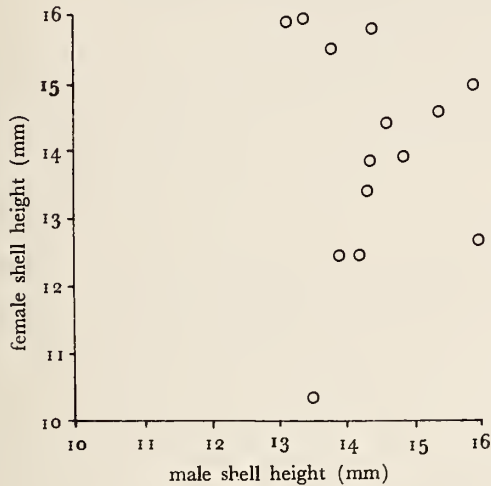


Figure 4

Relationship between size of male and size of female *Littorina nigrolineata* involved in intra-specific copulations

been recorded in *Littorina planaxis* Philippi, 1847 (GIBSON, 1964), *L. scabra* (Linnaeus, 1758), *L. pintado* Wood, 1828 and *L. picta* Philippi, 1846 (STRUHSAKER, 1966), *L. scabra* and *L. irrorata* Say, 1822 (GALLAGHER & REID, 1974). I have also observed male *L. mariae* Sacchi & Rastelli, 1966 in copulation with *L. rudis* females at Trwyn y Penrhyn and *L. rudis* males copulating with *L. neritoides* (Linnaeus, 1758) at Trearddur Bay, Anglesey.

There is considerable evidence that *Littorina* species follow mucus trails made by conspecific individuals and that pheromones are involved as specific attractants (GIBSON, 1964; DINTER & MANOS, 1972; WELLS & BUCKLEY, 1972; DINTER, 1974; HALL, 1974). In these studies there was no direct evidence of sex pheromones in the mucus trails. The present paper has shown that males of *L. rudis* and *L. nigrolineata* cannot differentiate between conspecific males and females, at least in the early stages of copulation, supporting the contention that female *Littorina* do not attract males with specific sex pheromones.

Although the copulatory behaviour of *Littorina rudis* and *L. nigrolineata* appears to be inefficient, males copulating with individuals other than conspecific females may not release spermatozoa. In other studies male-male copulations were observed to last for less time than male-female copulations, but these observations were made under laboratory conditions and their relevance to the field

situation is not known. Nevertheless, when time available for mating and feeding is limited, *e.g.*, at high shore levels, the time and energy wasted by copulating with the wrong partner may be significant and adversely affect the reproductive success of individuals living at these shore levels.

SUMMARY

The incidence of copulations by male *Littorina rudis* and *L. nigrolineata* with individuals other than conspecific females was found to be high.

There was no relationship between size of male and female individuals involved in intra-specific copulations.

It is considered improbable that mucus trails secreted by *Littorina* species contain sex pheromones.

The inability of males to discriminate between conspecific females and other individuals may significantly lower reproductive success and fitness at higher shore levels.

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